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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/808,267	03/11/2004	Jonathan Schuler	NC 84,655	4786
26384	7590	02/14/2006	EXAMINER	
NAVAL RESEARCH LABORATORY ASSOCIATE COUNSEL (PATENTS) CODE 1008.2 4555 OVERLOOK AVENUE, S.W. WASHINGTON, DC 20375-5320			EDWARDS, PATRICK L	
		ART UNIT	PAPER NUMBER	2621

DATE MAILED: 02/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)
	10/808,267	SCHULER ET AL.
	Examiner	Art Unit
	Patrick L. Edwards	2621

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 04 January 2006.
- 2a) This action is **FINAL**.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 2-5 and 7-11 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 2-4,7,8 and 11 is/are rejected.
- 7) Claim(s) 5,9 and 10 is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All    b) Some \* c) None of:
    1. Certified copies of the priority documents have been received.
    2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 12-21-2005.
- 4) Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: \_\_\_\_\_.

## **DETAILED ACTION**

1. The response received on 01-06-2006 has been placed in the file and was considered by the examiner. An action on the merits follows.

### ***Response to Arguments***

2. The arguments filed on 01-06-2006 have been fully considered. A response to these arguments is provided below.

### **Drawing Objections**

#### **Summary of Argument:**

- (a) Applicant alleges that the drawings have been amended by “renumbering one of the instances of 210, and by removing the acronym TARID.”
- (b) Applicant has not amended claim 7 to indicate that it is prior art, and insists that “nothing in the specification indicates that the software code that is shown in this drawing figure is prior art.”

#### **Examiner’s Response:**

- (a) The replacement drawing sheet has been received and the second instance of identifier 210 has been removed. The acronym TARID, however, has not been removed. The previous objection will therefore be repeated below.
- (b) The examiner respectfully disagrees. The original specification—which has now been amended—stated the following: “Fig. 7 illustrates, in MATLAB script, an algorithm that implements sub-pixel image displacement by numerical solution to the Brightness Constancy Constraint (BCC) equation (Algorithm described in Digital Video Processing, A.M. Tekalp, 1995 Prentice Hall, pp 81-86).” Quite clearly, this states that Figure 7 constitutes prior art. Applicant’s deletion of the above parenthetical does not modify the status of the Figure. It is still prior art. Accordingly, it should be labeled as such.

### **Information Disclosure Statement**

#### **Summary of Argument:**

In the previous office action, the examiner requested the submission of 6 documents that were deemed highly probative to the examination of the application. 5 out of those 6 documents have been provided.

#### **Examiner’s Response:**

The examiner appreciates the submission. Regarding the ‘O’Neal’ document that was not submitted because “the document ... has markings indicating it is not publicly releasable and may contain classified material”: The examiner questions whether a document that was published 13 years ago at an IRIS proceeding is really still a classified document. The examiner would like to respectfully request that the applicant make sure that this is indeed classified. If it is definitely still classified, then the examiner will withdraw the request.

### **35 USC 112, Second Paragraph Rejections**

#### Summary of Argument:

The previous 112(2) rejections have been corrected and are withdrawn. A new grounds of rejection under 35 USC 112(2) will be provided below.

#### *Allowable Subject Matter*

3. Claim 5 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.
4. Claims 9 and 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

#### *Drawings*

5. Figure 7 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Figure 2 contains the word "TARID." It does not appear that this word is used in the disclosure, and it is not clear what this word means.

#### *Claim Rejections - 35 USC § 112*

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
7. Claims 4, 5, and 7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.  
Claims 4 and 5 contains a reference to "said video sequence," which lacks antecedent basis in the claim.  
Claim 7 depends from a cancelled claim.

#### *Claim Rejections - 35 USC § 102*

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8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

9. Claims 1, 2, 4, 5, and 8 are rejected under 35 U.S.C. 102(a) as being anticipated by Rumo et al.

("Superresolution in Images Using Optical Flow and Irregular Sampling")

Regarding claim 4, Rumo discloses estimating motion associated with said video sequence of images (Rumo pg. 1: "integer pixel shift estimator." The estimate of a shift between images is motion estimation.).

Rumo further discloses associating pixels of the sequence with the following quantities:

- pixel intensity; x-coordinate and y-coordinate location; x-coordinate and y-coordinate location estimate uncertainty (Rumo pg.2: The reference describes using a taylor series for a subpixel shift estimator that estimates subpixel shift in both the x and y direction. Obviously, each of the pixels have an associated intensity and an x and y coordinate location. This knowledge is inherent in performing the shift estimate itself. The subpixel shift estimator further shows that the process of motion estimation (shift estimation) also includes associating x and y coordinate uncertainties (The x and y uncertainties are used by the taylor series in the determination of a shift between two images. Thus, the x and y coordinate uncertainties are associated with each pixel in the process of performing this estimate.)).

Rumo further discloses assembling said video sequence of images to form a single composite image based on estimate positions of individual pixels (Rumo abstract: "from these shifted low resolution images ... a higher resolution aliasing-free image can be constructed")

Rumo further discloses restoring a composite image (Rumo abstract: "the reconstructed image").

Regarding claim 8, which merely claims a system comprising a computer executing software to perform the method of claim 1, such a system is inherent in the Rumo disclosure because the inputting of images, the computations involving those images, and the subsequent display of enhanced images inherently require a computer executing software in order to be performed.

As applied to claim 2, Rumo discloses selecting a single image frame from said video sequence as a template from which motion of all other frames of video is estimated (Rumo pg. 1: "we compute the estimate shift for all images one-by-one with a single, arbitrary chosen, reference image." The reference image described in Rumo is analogous to the claimed template image.).

#### *Claim Rejections - 35 USC § 103*

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rumo as applied to claim 1 above, and further in view of applicant's admitted prior art. The arguments as to the relevance of Rumo as applied above are incorporated herein.

As applied to claim 3, Rumo further discloses the step of estimating motion associated with said video sequence assumes a displacement (Rumo pg. 1: again, the shift between images is a displacement. Rumo assumes that such a displacement exists).

Rumo further discloses estimating nearest pixels displacement by image correlation (Rumo pg. 1: The reference describes that the integer pixel shift estimator is based on crosscorrelation).

Rumo further discloses tagging every pixel in said template with a whole integer coordinate (Rumo fig. 2: The images of fig. 2a can be seen to be broken up into a coordinate. Inherently, each one of these pixels is defined by a spatial location (i.e. "tagged"). We know that the interval coordinates are whole integers because of sec. 4.2 which describes that the size of the original image was 300 x 200.).

Rumo further discloses tagging every pixel in other frames with an adjusted coordinate based on the displacement of said other frames (Rumo fig. 2: The reference shows that the pixels of other frames are "tagged" (i.e. defined by a spatial location) based on the displacement with respect to the template image).

Rumo discloses estimating subpixel displacement, but fails to expressly disclose estimating subpixel displacement by a least squares solution of brightness constancy constraint equations applied to aligned images. Applicant's admitted prior art, on the other hand, discloses "implement[ing] sub-pixel image displacement by numerical solution to the Brightness Constancy Constraint" (see pg. 8 of applicant's spec.). It would have been obvious to one reasonably skilled in the art at the time of the invention to modify Rumo by using the well known and robust algorithm taught by applicant's admitted prior art. Such a modification would have allowed for a numerical solution to the problem of subpixel displacement.

11. Claim 11 is rejected under 35 U.S.C. 102(b) as being anticipated by Richard H. Vollmerhausen et al., "Analysis of Sampled Imaging Systems" (Vollmerhausen)

Vollmerhausen discloses estimating motion associated with a sequence of images collected by an electro-optic imaging system from an object source (Volmerhausen pg. 130: The reference describes determining the optical flow (i.e. estimating motion) of a sequence of images.

Vollmerhaussen further discloses assembling said sequence of images into a composite image (Vollmerhausen pg. 130) by:

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- **estimating positions of individual pixels of the sequence of images and uncertainties of the positions** (Vollmerhausen pg. 130 bottom paragraph: The reference describes a shift estimation. It is fundamental that in a shift estimation we are estimating both (a) positions of individual pixels and (b) uncertainties of these positions)
- **estimating an intensity of each pixel of the composite image** (Vollmerhausen pg. 133: The shows pictures which are estimates of image intensity).
- **generating a noise estimate associated with the intensity of each pixel of the composite image** (Vollmerhausen pg. 133, final paragraph: The reference describes a noise estimation),
  - **The intensity and the noise estimate being derived from a subsample of pixels of the series of images located within the coordinate of a composite image's spatial location** (Volmerhausen generally: The reference describes transforming the scan sequence into an image of higher sampling density. A higher sampling density means that the intensity and noise estimates are being performed as a sub-pixel analysis. This is the only way that a method to increase spatial resolution could function.

Volmerhausen further discloses restoring the composite image based on said noise estimates and said intensity (Volmerhausen pg. 136).

#### *Conclusion*

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick L Edwards whose telephone number is (571) 272-7390. The examiner can normally be reached on 8:30am - 5:00pm M-F.

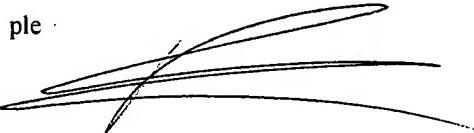
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joe Mancuso can be reached on (571) 272-7695. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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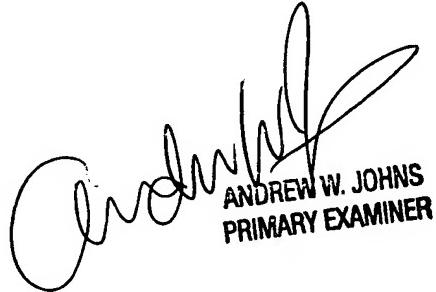
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Patrick L Edwards

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Andrew W. Johns  
PRIMARY EXAMINER